



South Carolina Department of Health  
and Environmental Control

## **TIER II ASSESSMENT**

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## Tier II Assessment Guidelines

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### I. INTRODUCTION

This document outlines a Tier II methodology for sites with petroleum releases from underground storage tanks (USTs) where additional investigation of site-specific conditions is warranted based on existing data from previous investigations. This document establishes performance standards (i.e., describes the minimum elements necessary) for a Tier II while allowing technical flexibility so that the work may be completed in an effective manner. The results of the Tier II are to be used to establish appropriate site-specific target levels and recommendations for future actions as outlined in

the Risk-Based Corrective Action (RBCA) document. All site rehabilitation activities related to a release from a regulated UST system require technical approval by the Department in accordance with state and federal directives. The Tier II plan and report shall be signed and stamped by a qualified professional registered in the State of South Carolina. All site rehabilitation activities must be conducted by a SCDHEC certified site rehabilitation contractor as required by the State Underground Petroleum Environmental Response Bank (SUPERB) Site Rehabilitation and Fund Access Regulations R.61-98. Additionally, preapproval of all costs is required for payment from the State Underground Petroleum Environmental Response Bank (SUPERB) Account. For SUPERB allowable costs and financial forms, see the SUPERB Account Allowable Costs Document. Once any SUPERB deductible is met, the Department can directly procure the services of a site rehabilitation contractor for the UST owner or operator upon their request.

The contractor and/or UST owner or operator shall obtain all off-site access agreements and/or encroachment permits necessary for investigation and well installation. The Division of UST Management will assist in acquiring access should the contractor encounter difficulties with property owners. All encroachment permit requests for South Carolina Department of Transportation shall be submitted to the Division of Underground Storage Tank Management with the Tier II Plan for processing. The exact location and distance from properly identified state or county road intersections shall be clearly shown on a map for all proposed temporary or permanent well locations.

To assist with the preparation of the Tier II Plan, the Freedom of Information office may be contacted at (803) 898-3882 to access the technical file if previous site data is not available from the tank owner or operator.

## **II. TIER II ASSESSMENT PLAN**

A concise Tier II plan (see Appendix A) shall be submitted to the Department for review and approval prior to implementation. The Tier II plan shall include:

- A. Site Information** - A brief summary of all general information (site address and tank ownership) and any pertinent information that has not previously been submitted to the Department.
- B. Site Maps** - A copy of the relevant portion of a 7.5 minute United States Geological Survey (USGS) topographic map showing the site location and a scaled site map shall be included. The site map shall indicate the locations of all structures, existing and/or former UST(s), and existing permanent monitoring wells.
- C. Field Screening Methodology** - The specific field screening methodology shall be discussed. **The use of field screening methods to optimize the number and location of permanent monitoring wells is required.**
- D. Permanent Monitoring Wells** - The maximum number and depth of permanent monitoring wells estimated to be necessary to define the concentrations and extent of ground-water Chemicals of Concern (CoC). If the contractor later determines that this number is insufficient, additional permanent monitoring wells or additional footage wells shall be requested. Additional wells require preapproval by the Department.

- E. Implementation Schedule** - A schedule indicating the startup and completion dates for all proposed activities and the submittal date for the Tier II report. The time frame for submittal of the Tier II report shall be 90 days from the date of Tier II plan approval or at a time designated by the Department.

In some cases, components of the assessment may be predetermined by the Department and plan preparation by the contractor shall not be necessary (e.g., installation of a compliance well or free product recovery test).

### **III. TIER II IMPLEMENTATION**

- A. Objectives** - The objectives and performance standards of the Tier II shall be:

1. to delineate the horizontal and vertical extent of CoC in the soil and ground water,
2. to identify and evaluate all exposure pathways,
3. to characterize the nature of the CoC present,
4. to adequately define the site geology and hydrogeology, and
5. to use fate and transport analysis to predict the actual or potential impact of CoC on receptors. The Department shall allow some flexibility in meeting these objectives, provided that the contractor shall meet these performance standards.

- B. Receptor - Utilities Survey / Site Survey** -

1. All water wells (drinking and non-drinking) and other potential receptors (i.e. surface waters, wetlands, basements) within a 1000 ft. radius of the facility shall be depicted on the relevant portion of the appropriate United States Geological Survey 7.5 minute topographic map.
  - a) Note and record on a site vicinity map the current use of the site and adjacent land (agricultural, residential, commercial, industrial). The local city or county administrative authorities shall be contacted for information pertaining to any applicable zoning and land use ordinances. Zoning ordinances set broad-scale restrictions on property development such as residential, commercial, or industrial. Land use ordinances may establish smaller scale restrictions such as disallowing the installation of drinking water or irrigation wells. A photocopy of the applicable sections or summary of the ordinances shall be provided. If a copy cannot be obtained, name, phone number, and business address of the appropriate authorities shall be provided with a summary of the relevant information.
  - b) Provide a copy of the applicable portion of a tax map. This map shall depict the location of the facility, all impacted properties, all properties located adjacent to the impacted properties, and any property on which a permanent monitoring well was installed as part of the investigation. The names and addresses of the owners of each of these properties shall be provided.
  - c) Depict on a scaled site map to the nearest one foot all aboveground and underground structures, underground utilities (electrical, water, storm sewer, sanitary sewer, natural gas, telephone, cable TV, vaults, manways, etc.) within a 250 ft. radius of the facility. The depth (+ 2 feet) shall be identified.

- d) Immediately screen, using an organic vapor analyzer (OVA) or other similar properly calibrated field instrumentation, any receptor that may be potentially impacted (e.g., underground utility vault adjacent to the property line) within 1,000 feet. Any water supply well within 500 feet must be sampled immediately for laboratory analysis. Provide the name, address and a contact telephone number for the owner of any impacted receptors to the DHEC contact person within 48 hours of detection. This information should also be included in the report.
  - e) If the field screening analysis from a receptor indicates the presence of CoC, forward a vapor or ground-water sample to a certified laboratory and immediately notify the Department site project manager at (803) 898-4350. The project manager should be provided the name, address, and a contact telephone number for all property owners with an impacted receptor. All field screening data and laboratory analysis shall be included in the Tier II report.
2. A comprehensive initial site survey shall be conducted if not already completed. This survey shall include the locations and relative elevations of, at a minimum, potential receptors, existing or former underground storage tanks, lines, dispensers, monitoring wells and above and below ground structures. A South Carolina Registered Surveyor shall perform the survey. The surveyor's certification number, business address, telephone number, and date of survey must be on any applicable maps.

**C. Soil Boring Installation, Sampling, and Analysis** - If not previously defined and quantified, the horizontal and vertical extent of impacted vadose zone soil contamination shall be fully delineated according to the following:

1. Install soil borings as follows :
- a. UST Area : Install soil borings to a depth of 25 feet or to the ground water table, whichever is shallower, in the area formerly occupied by the USTs or adjacent to the currently operating USTs. Soil samples shall be collected at the surface and at five foot intervals to the boring terminus. **DO NOT TAKE SOIL SAMPLES BELOW THE WATER TABLE.**
  - b. Piping and Dispenser Area : Install borings to a depth of ten feet or to the ground water table, whichever is shallower, in the area formerly occupied by the lines and product dispensers or adjacent to the currently operating product lines and dispensers. Soil samples shall be collected at the surface and at two foot intervals to the boring terminus. **DO NOT TAKE SOIL SAMPLES BELOW THE WATER TABLE.**
  - c. Background Soil Boring : Install one soil boring to a depth of 10 feet or to the ground water table, whichever is shallower, at least thirty feet away from any USTs, product lines, dispensers, and other potential sources of CoC. If the site is too small to allow a separation of thirty feet, install this soil boring as far away from all USTs, product lines, dispensers, and other potential sources of CoC as possible. Collect a soil sample from below the "A" horizon unless precluded by a shallow water table. **DO NOT TAKE SOIL SAMPLE BELOW THE WATER TABLE.**

2. Soil Sample Descriptions:
  - a. Describe the lithology for each soil sample collected during boring installation and screen for organic vapors utilizing properly calibrated instruments (for other less volatile chemicals such as diesel or kerosene, alternative screening methods such as Field Gas Chromatograph, or immunoassay shall be used).
  - b. On separate logs for each boring, record the soil type, color of soil using standard methods, rocks or minerals present, split-spoon sample intervals, and any organic vapor and field screening measurements. Additionally, a qualitative indication of soil conditions (dry, moist, wet, saturated) shall be noted on the logs. The boring logs shall note the depth of each sample submitted for analysis.
3. A soil sample from each boring around the USTs, piping and dispensers shall be submitted to a Department certified laboratory for analysis as follows:
  - a. The soil sample from each boring with the highest organic vapor measurement shall be submitted to the laboratory for analysis. If the organic vapor measurements for all samples in a boring are within ten percent of each other, the sample from the greatest depth above the water table shall be submitted for analysis. Based on the organic vapor concentrations detected, the method of sample collection shall be either EPA method 5030B (high-level >200 ug/kg) or EPA method 5035 (low-level <200 ug/kg) protocol, as appropriate. The number and type of sampling containers, weighing of samples in the field, use of preservatives, and holding times must be in accordance with SW 846, Test Methods for Evaluating Solid Wastes. This information must be submitted to the Division for review. All industry standard quality assurance and quality control methods shall be followed for shipping (sample label, sealed sample containers, chain of custody prepared, stored on ice).
  - b. The soil samples (one from each soil boring) shall be analyzed for the appropriate analyses as listed in Table 1.

*Table 1. Analysis Parameters*

<i>TABLE 1</i>	<i>Soil Samples</i>	<i>Water Samples</i>
<i>PRODUCT</i>	<i>Analyte....Method*.....RL**</i>	<i>Analyte.....Method*.....RL**</i>

Gasoline, Diesel, Fuel Oil, Kerosene	<b>BTEX</b> .....5035/8260B.....5 Fg/kg <b>Naphthalene</b> .....5035/8260B.....5 Fg/kg <b>PAH</b> .....3550B/8270C.....660 Fg/kg <b>TPH (DRO)</b> .....3550B/8015B.....10mg.kg <b>Total Organic Carbon</b> .....9060.....10mg/kg	<b>BTEX</b> .....5030B/8260B.....5 Fg/l <b>Naphthalene</b> .....5030B/8260B.....5 Fg/l <b>MtBE</b> .....5030B/8260B.....40 Fg/l <b>EDB</b> .....5030B/8260B.....5 Fg/l <b>PAH</b> .....3510C/8270C.....10 Fg/l <b>Dissolved Oxygen &amp; Carbon</b> <b>Dioxide</b> .....SM4500-O G.....1.0 mg/l <b>Ferrous Iron</b> .....SM3500-Fe D.....30 Fg/l <b>Total Lead.(Unfiltered)</b> .....7421.....5 Fg/l <b>Methane</b> .....Kerr Method......1mg/l <b>Nitrates</b> .....9056 or 9210.....100 Fg/l <b>Sulfates</b> .....9056 or 9038.....1mg/l
Waste Oil	<b>BTEX</b> .....5035/8260B.....5 Fg/kg <b>Naphthalene</b> .....5035/8260B.....5 Fg/kg <b>PAH</b> .....3550B/8270C.....660 Fg/kg <b>TPH (DRO)</b> .....3550B/8015B.....10mg.kg <b>Total Organic Carbon</b> .....9060.....10mg/kg <b>Metals:</b>  <b>Lead</b> .....7421.....250 Fg/kg <b>Mercury</b> .....7471A.....10 Fg/kg <b>Arsenic</b> .....7060A.....250 Fg/kg <b>Barium</b> .....6010B.....2,500 Fg/kg <b>Cadmium</b> .....7131A.....500 Fg/kg <b>Chromium</b> .....7191.....250 Fg/kg <b>Selenium</b> .....7740.....250 Fg/kg <b>Silver</b> .....7761.....250 Fg/kg	<b>BTEX</b> .....5030B/8260B.....5 Fg/l <b>Naphthalene</b> .....5030B/8260B.....5 Fg/l <b>TPH</b> .....9071.....40 Fg/l <b>PAH</b> .....3510C/8270C.....10 Fg/l <b>Dissolved Oxygen &amp; Carbon</b> <b>Dioxide</b> .....SM4500-O G.....1.0 mg/l <b>Ferrous Iron</b> .....SM3500-Fe D.....30 Fg/l <b>Nitrates</b> .....9056 or 9210.....100 Fg/l <b>Sulfates</b> .....9056 or 9038.....1mg/l <b>Methane</b> .....Kerr Method.....1mg/l <b>Metals (Unfiltered):</b> <b>Lead</b> .....7421.....5 Fg/l <b>Mercury</b> .....7470A.....0.2 Fg/l <b>Arsenic</b> .....7060A.....5 Fg/l <b>Barium</b> .....6010B.....50 Fg/l <b>Cadmium</b> .....7131A.....0.1 Fg/l <b>Chromium</b> .....7191.....5 Fg/l <b>Selenium</b> .....7740.....5 Fg/l <b>Silver</b> .....7761.....5 Fg/l

**BTEX** - Benzene, Toluene, Ethyl-benzene, Xylenes  
**Naphthalene-** TOTAL Naphthalenes  
**MtBE** - Methyl Tertiary Butyl Ether  
**PAH** - Polynuclear Aromatic Hydrocarbons (Benzo(a)anthracene, Benzo(b)flouranthene, Benzo(k)flouranthene, Chrysene, Dibenz(a,h)anthracene)  
**EDB** - Ethylene dibromide  
\* - Or equivalent method that can achieve the same reporting limits; for dissolved oxygen and ferrous iron, includes field methods  
\*\* - RL = Reporting Limit

- c. Two additional samples from a minimum of one of the borings exhibiting the highest organic vapor measurement will be forwarded to a certified lab for:

- 1) One soil sample shall be collected from the terminus of the boring, above the ground water table, for a grain size/hydrometer analysis to determine the sand, silt and clay fractions at 0.074 millimeters (#200 screen) and 0.004 millimeters respectively.
  - 2) The second soil sample shall be collected from the stratigraphic level exhibiting the highest organic vapor measurement above the ground water table and analyzed for Total Petroleum Hydrocarbons (TPH) using Environmental Protection Agency (EPA) method 3550.
- d. A soil sample collected from a background soil boring shall be analyzed for total organic carbon (TOC) utilizing EPA method 415.1.
- e. Additional soil samples above or below the water table may be submitted to a certified laboratory for grain/sieve analysis, TPH or TOC. The Department shall preapprove all samples.
4. **Soil Boring Abandonment** - All soil borings and screening points shall be properly abandoned with neat cement grout pursuant to the South Carolina Well Standards and Regulations R.61-71 by or under the supervision of a South Carolina certified well driller.
- D. **Soil Leachability Model** - If not previously evaluated, calculate the site specific target levels for each chemical of concern in the soil. The Soil Leachability Model provided in the "Risk-Based Corrective Action for Petroleum Releases" document shall be utilized unless an equivalent method is approved. Results of the soil leachability model shall be recorded on leachability forms. The calculated ground-water site specific target levels (SSTL) shall be used to calculate soil SSTL values. If ground-water is less than 5 feet below ground surface (bgs), the Soil Leachability Model is not required. See Appendix A for forms.
- E. **Field Screening** - The contractor shall propose in the Tier II plan appropriate sample collection methodology and field screening techniques (FST) based on the anticipated CoC. The method for sample collection and the field screening technique shall be at the discretion of the consultant. The objective shall be to adequately delineate the horizontal and vertical extent of the petroleum constituents in soil and ground water during one equipment mobilization. The objective is to use the FST to optimally locate, and reduce the number of, permanent monitoring wells. **Field screening locations, field sampling results, and proposed permanent monitoring well locations are to be provided to the DHEC project manager for approval prior to the installation of permanent well locations.**

Prior to advancing the first field screening point, the depth to ground water shall be gauged in all existing monitoring well(s). The initial field screening points should be installed in a radial pattern in the immediate vicinity of the suspected source(s). These field screening points shall not be advanced deeper than five feet below the water table as gauged in existing wells. Once the core of the plume has been identified, a deeper field screening point shall be advanced. Water samples shall be screened for petroleum constituents at five foot intervals and at any discernable changes in soil type (based on either well logs from previously existing monitoring wells or based on significant changes in the "ease" of advancement of the field screening points) with a properly calibrated field screening instrument. The deeper field screening point may be terminated upon either documentation of two consecutive field screening samples below



detection limits or risk-based screening levels, or advancement refusal, whichever occurs at the shallower depth. The remaining field screening points for horizontal delineation shall be advanced to the depth which exhibited the highest field screening results in the deeper field screening point. For example, if the highest concentration of petroleum is present in a sand stringer located eight feet below the water table, then all additional field screening points shall target that stratigraphic interval. The objective of the screening shall be to adequately delineate the horizontal and vertical extent of the free phase and dissolved phase petroleum CoC. Field screening results, along with proposed permanent monitoring well locations, are to be provided to the Department project manager at (803) 898-4330 for approval prior to the installation of permanent well locations.

The contractor shall provide the following:

1. FIELD INSTRUMENT - The brand name, model number, and serial number for each instrument utilized.
2. FIELD CALIBRATION - Written verification of the calibration of the instrument in the field for each day of reported analysis. This shall include the method of calibration, the concentration(s) and composition of the standard, and the existing conditions at the time of calibration (temperature, humidity, etc.). This calibration shall be accomplished using a standard indicative of the constituents being tested for (i.e., if analyzing for gasoline, calibrate the instrument with gasoline). This allows the method to provide measurements of the actual concentration of the subject constituent (parts per million TPH as Gasoline) instead of span gas equivalents.
3. FIELD ANALYTICAL METHOD - This shall include protocols for sample collection and handling, as well as a detailed description of the field analysis. This shall also include information pertaining to the basis for the method and how it works.

Any reference, or lack thereof, to any specific assessment or remedial technology does not constitute an endorsement or recommendation by the Department. Technologies are discussed for illustrative purposes only. Any technology which accomplishes the Tier II performance standards and meets all regulatory requirements is acceptable.

**F. Install permanent monitoring wells** - The number and location of the permanent monitoring wells shall be based on the field screening results with the Department's preapproval. The wells shall be installed such that the horizontal and vertical extent of the ground-water chemicals of concern are delineated for the monitoring of all exposure pathways. The contractor is expected to define the extent of the chemicals of concern to the maximum extent possible. Unnecessary monitoring wells should not be installed.

1. Monitoring wells shall be installed by a licensed South Carolina Certified Well Driller and in accordance with the S. C. Well Standards and Regulations (R.61-71).

A two-inch inside diameter (ID) PVC casing and screen shall be used for the water table monitoring wells, unless a written variance is granted by the DHEC project manager prior to installation. The well screen length should be ten feet for shallow wells. However, if the contractor is aware of significant ground-water level fluctuations, a longer screen length may be necessary and shall be specified in the plan. Well screens for all type II monitoring wells must bracket the water table and approximately one-half of the well screen should be positioned below the water table. The cost for

installation and abandonment of smaller diameter monitoring wells shall be the same as for a 2 inch well. Smaller diameter wells will be approved on a case-by-case basis.

Sand pack and screen slot size shall be at the discretion of the contractor. Casing and screen shall be threaded and the use of PVC glue or O-rings shall not be allowed. The sand pack shall be installed, using the tremie method, adjacent to the screen. It shall extend one to two feet above the well screen. A minimum two-foot thick bentonite seal shall be placed in the well annulus above the filter pack. The bentonite seal, gravel pack, and grout shall be installed using a tremie pipe.

The casing stick-up length (within the manhole) shall be such that it can prevent water entry into the well if the manhole seal were to fail. All wells shall be terminated at grade unless otherwise directed by the Department. All wells shall be equipped with a manhole cover with bolts and a locking well cap.

A minimum of one vertical assessment well shall be proposed unless the vertical extent of the contamination can be reasonably determined, or estimated, by another method and/or if the geology precludes the potential of vertical migration of the chemicals of concern. The deep well is to be paired with a water table well (preferably the water table well with the highest concentration of chemicals of concern) to determine vertical extent of the chemicals of concern and the vertical hydraulic gradient. The diameter of the deep well boring must be such that installation of the telescoping monitoring well can easily be accomplished. A six-inch ID well casing shall be advanced at least five feet deeper than the bottom of the adjacent water table well screen or to the first confining unit, whichever is less. The annular space around the casing must be pressure grouted to the surface in accordance with the South Carolina Well Standards and Regulations and allowed to cure for at least twenty-four hours. The boring must then be advanced through the inside of the six-inch ID well casing. Data from the deep field screening point shall be used to determine the appropriate depth of the deep vertical assessment monitoring well. A sand packed two-inch ID well casing shall be installed inside the six-inch ID well casing. Well screen length shall be five feet. The well will be completed as stated above.

Unnecessary permanent monitoring wells shall not be installed (e.g., wells installed a significant distance beyond and existing temporary or permanent well that exhibits no appreciable concentration of CoC or deep wells installed where ground-water analyses indicated minimal concentration of CoC in the shallow monitoring wells).

2. All soil cuttings and ground water generated during boring construction and monitoring well development/purging shall be temporarily stored in 55 gallon drums or equivalent containers.
3. The development method, chosen by the contractor, shall be capable of removing formation cuttings drilling fluids and additives to provide relatively sediment-free water samples that are typical of the aquifer.
4. Depth to water (or product) shall be determined using equipment capable of detecting the free product/water interface prior to development. If free product is present, the apparent thickness to 0.01 foot accuracy shall be measured.
5. The purge waters shall be measured for pH, specific conductance, and temperature.

Purging is considered complete once the ground-water temperature and pH measurements have equilibrated. Purging will not be performed in a well if the thickness of free product exceeds 0.01 inches. All measurements shall be submitted to the Department in the Tier II Report.

- G. Ground Water Sampling** - Prior to collecting a ground-water quality sample from each well, the static water level and the dissolved oxygen and carbon dioxide content shall be measured and reported. Sample collection for laboratory analyses shall not be performed less than 24 hours after well development. Metal samples should not be filtered. One ground-water sample per well and for each possible exposure point shall be collected following the initial installation of all wells. The sampling logs shall note the location and type of each sample submitted for analysis. Each ground-water sample shall be properly prepared for shipping (sample label, sealed sample container, no air in the sample, chain of custody prepared, stored on ice, etc.) and shipped to a certified laboratory.
- H. Ground Water Analysis** - The ground-water sample from each well and possible exposure point shall be shipped for appropriate analysis as listed in Table 1. All laboratory analysis must be performed by a laboratory currently certified by the Department for the relevant analysis. Laboratory data for each sample (field sampling logs, chain of custody forms, certificates of analysis, and the lab certification number) shall be added to the Appendix of the report.
- I. Aquifer Characteristics** - Determine aquifer characteristics. The completion of a pumping test is preferred whenever possible. In cases where a pumping test cannot be conducted because of technical (e.g., well yields are too low) or financial (e.g., wastewater disposal is cost-prohibitive) reasons, aquifer slug tests shall be acceptable. At least three separate slug tests shall be conducted in different on-site wells to determine aquifer characteristics unless otherwise specified by the Department. At least one slug test shall be conducted in the deep well. All wastewater generated during aquifer tests shall be properly containerized and disposed.
1. Slug Tests - Data shall be analyzed in accordance with industry standards (Horslev, Bower and Rice, etc.). The slug test shall be reported on the slug test forms. See Appendix A.
  2. Pumping Test - To ensure that the pumping test data is representative, the test shall be conducted using a sufficient pumping rate and duration to stress the aquifer. Therefore, the pumping test shall have a duration of at least six hours to a maximum of twenty four hours based on site-specific data. Data shall be analyzed in accordance with industry standards. The pumping test shall be reported on the pumping test forms. See Appendix A. Generation of more than 6,000 gallons of waste water during a pumping test will require a permit from the Department.
- J. Free Product Recovery Test** - If free product is encountered in a permanent monitoring well, then a recovery test or bail down test shall be conducted to determine free product recovery rates and true thickness. If possible, a ground-water sample shall be taken from the well after all measurable free-product is removed.
- K. CoC Fate and Transport** - The fate and transport of the chemicals of concern in the ground water and in vapors from the source area shall be predicted. The contractor shall propose in the Tier II plan the method most appropriate for the site. The completion of a relatively simple mathematical and/or algebraic or semi-analytical expression shall be preferred initially. Where a completed pathways may exist, a more complex computer model shall be

used.

1. Mathematical and/or algebraic or semi-analytical expressions. For ground water, the contractor shall utilize Domenico's Fate and Transport Model provided in the "Risk-Based Corrective Action for Petroleum Releases" document or equivalent model. RBSL values should not be recalculated, if values are listed in Appendix B Risk-Based Corrective Action for Petroleum Releases.
  2. Computer fate and transport modeling. For ground water, the contractor shall utilize SOLUTE, AT123D, BIOPLUME-II, or equivalent model. For vapors, the contractor shall utilize Farmer, Thibodeaux-Hwang, SeSoil, Jury, Box, or an equivalent model.
- L. Tier Evaluation** - Historical data and the information obtained during this scope of work to perform a Tier 2 Risk Evaluation shall be used, as appropriate. This evaluation includes, but is not limited to, identification of exposure pathways, characterizing the nature of the CoC present, the establishment of exposure points, site-specific target levels, and points of compliance and recommendations for future actions. This evaluation shall be performed in accordance with the "Risk-Based Corrective Action for Petroleum Releases" document.
- M. Final Survey** - A final survey to tie-in field screening points and permanent monitoring well locations and elevations to an assumed elevation shall be performed. This subsequent survey may be performed by the contractor.
- N. Waste Disposal** - Sample, analyze, transport, and dispose of any soil or wastewater generated in accordance with the Department's guidelines. Sampling and disposal shall be the responsibility of the contractor. It is the responsibility of the contractor to acquire signatures for the disposal manifests. Categories of waste disposal include:
1. **Wastewater** -
    - a) Water generated from well development, purging and/or sampling.
    - b) Water generated from a pumping test.
  2. **Free Product** - any product recovered from the sub-surface.
  3. **Soil** - soil that requires treatment in concurrence with the Department.

#### IV. Tier II Report

A final report of findings or Tier II Report shall be submitted to the Department by the date approved by the Department, and shall include, at a minimum, the following elements:

**A. Introduction**

- ! Regional geology and hydrogeology.
- ! Receptor survey results; the results shall include all known ground-water quality and public and private ground-water usage. See Appendix B for the format to be used for summarizing this data.
- ! Site location maps; the Tier II Report shall include a copy of the relevant portion of a

USGS topographic map showing the site location and the locations of all public and private wells and other potential receptors within 1000 feet of the site. A copy of the relevant portion of a tax map depicting the location of the facility, all impacted properties, and all properties located adjacent to the impacted properties shall also be included with property owner names, addresses, and phone numbers. The Tier II shall also include a scaled vicinity map that indicates site location, surface drainage, structures, roads, and adjacent property uses.

## **B. Assessment Information**

- ! Site-specific geology and hydrogeology;
- ! Site potentiometric map; the map shall show the direction of ground-water flow for the surficial aquifer.
- ! Potentiometric data for the site shall be listed in tabular form.
- ! Assessment results; the Tier II Report shall include a brief discussion of the assessment and results. The discussion shall include any methodology used that is not outlined in the Tier II plan.
- ! Site assessment map; the Tier II Report shall include a scaled, surveyed map that shows structures, underground utilities, potential receptors, USTs and associated piping and dispensers, and the locations of all sampling points and monitoring wells. The site assessment map shall be certified by a South Carolina registered professional surveyor or if the map is derived from a certified survey map, then a copy of the survey map shall be included in the Tier II Report Appendix.
- ! CoC site maps; the maps shall show the known and estimated horizontal extent of CoC in the soil and ground water. Analytical values for the CoC shall be indicated at each sampling point. A separate map shall be used for each medium. See Appendix C for the format to be used summarizing data.
- ! Geologic cross-sections; the Tier II Report shall include two cross-sections showing the lithology and stratigraphy of the site, and the known and estimated vertical extent of CoC in the soil and ground water. One cross section shall include the source area. The cross-sections shall intersect at a 90-degree angle if possible.
- ! Analytical data; soil and ground-water analytical data for the site shall be given in tabular form.
- ! Aquifer evaluation results; the Tier II Report shall include a brief discussion of the aquifer evaluation and results. All data, graphs, and equations used to derive the aquifer characteristics shall be included in the Tier II Appendix.
- ! Aquifer characteristics: hydraulic conductivity, seepage velocity, etc. shall be summarized on the attached slug and/or pumping test forms, as appropriate. See Appendix A for pump or slug test forms.
- ! A brief description of the fate and transport model(s) used shall be presented. All assumptions shall be clearly identified. The input parameters are to be given in tabular

form. The method of model calibration for each CoC, if used, shall be discussed.

- ! A map or series of maps showing the predicted migration and attenuation of the CoC through time shall be presented. Total BTEX and TPH maps will not be used.

### **C. Tier 2 Risk Evaluation**

- ! Exposure pathway analysis. It is recommended that the site rehabilitation contractor fax all screening data, receptor locations, exposure points, compliance points to the project manager at (803) 898-4330 prior to the start of exposure modeling. The tier analysis shall be done in accordance with the "Risk-Based Corrective Action For Petroleum Releases" document. See Appendix B for the format to be used summarizing this data.
- ! SSTLs shall be calculated for each CoC and for each potential vapor, soil, and ground-water exposure pathway.
- ! Recommendations. The Tier II Report shall include recommendations for further action (Tier 3 assessment, active remediation, intrinsic remediation, etc.) as warranted by the Tier 2 evaluation.

### **D. Appendix**

- ! Assessment data and related documents. The Tier II Appendix shall include, but not be limited to: boring logs, well completion logs, laboratory data sheets and chain-of-custody forms, aquifer evaluation data, graphs, equations, and disposal manifests.
- ! The Tier II Appendix shall include: all fate and transport modeling assumptions, data input to each model, and all generated output data.

## **Appendix A**

**TIER II PLAN  
LEACHABILITY INPUT PARAMETERS  
LEACHABILITY RESULTS AND CONCLUSIONS  
SUMMARY OF SLUG TEST  
SUMMARY OF PUMPING TEST**

## **Appendix B**

**UTILITY FORMAT  
POTENTIAL RECEPTOR FORMAT  
CURRENT LAND USE FORMAT  
FUTURE LAND USE FORMAT**



## **Appendix C**

### **BOREHOLE FORMAT CoC FORMAT**

### **UTILITY FORMAT AND POTENTIAL RECEPTOR FORMAT**

#### Receptor Analysis

Describe all potential receptors and preferential pathways within a 1000-foot radius of the site.

Description of Receptor	Distance/Direction from Site

Utilities Survey

List the utilities on site, and adjacent to the site within a 250-foot radius, that could serve as exposure points or as preferential pathways.

Utility	On-site or Distance/Direction from site	Depth to Utility

Example format taken from DHEC 3542(07/1999)